VERSATILITY OF PERFORATOR-BASED V-Y ADVANCEMENT FLAPS IN RECONSTRUCTION OF COMPLEX MID BACK WOUNDS

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Reconstruction of complex mid back wounds is challenging due to the patient comorbidities and scarcity of reliable regional flap alternatives. Four consecutive cases treated with perforator based V-Y advancement flaps are reported. An effective repair was achieved in all the patients and the mean follow up period was 28 months. Our results indicate the efficacy of adipocutaneous flaps in complex spinal soft tissue repair and may help to refine the relevant algorhythm. © 2011 Wiley-Liss, Inc. Microsurgery 31:229–233, 2011.

Complex midline wounds in the back may have a congenital or acquired etiology. Defects in this area might have been subject to irradiation, may have failing previous surgical attempts, local infection, spinal instability, hardware exposure, or massive pressure sores. In addition to the local factors, there may be systemic comorbidities, which may further make it difficult to have a successful repair. After optimizing the systemic conditions and the underlying cerebrospinal disorders, coverage with muscle flaps has been an essential treatment option. The back can be divided into three anatomic regions to delineate the reconstructive strategy.[1] In contrast to its upper and lower counterparts, the middle third of the back or thoracolumbar region lacks reliable conventional muscle flap options. Distally pedicled or free latissimus dorsi muscle/musculocutaneous flap and bilateral paraspinal muscle flaps have been used with variable success.[1–9] In this report, we present the mid back repair with the local adipocutaneous perforator flaps in four consecutive patients.

ANATOMY AND FLAP DESIGN

Thoracolumbar skin supplied by two main vascular sources: segmental dorsal perforators of lower posterior intercostal arteries (mainly 10th and 11th) can be found within 5 cm from the midline and the relevant flap can be prepared from a rectangular area, extending from the dorsal midline to the midaxillary line laterally and the iliac crest inferiorly.[10] Four pairs of lumbar artery (mainly the second and fourth) perforators are present immediately lateral to the erector spinae muscles, within 5–9 cm from the midline, supplying a roughly triangular area overlapping the inferior portion of the former territory.[11,12] Regional perforators were determined by means of a hand-held-Doppler ultrasound device, preoperatively. Flap design was quite similar to that used in a V-Y skin advancement flap, which was outlined adjacent to the defect, considering the skin elasticity and marked perforators. Flap elevation commenced through the defect side with limited caudal and cranial incisions toward the anticipated perforator location, preferably in a suprafascial pattern to facilitate the procedure. When presence of perforator(s) was ensured, incisions and flap harvest were carried out in a regular manner.

CASE REPORTS

Case 1

A 41-year-old ambulatory female patient underwent a partial spinal tumor (ependymoma) resection with total laminectomies between T12–L3 levels. The patient presented with cerebrospinal fluid (CSF) leakage from the dorsal midline incision scar after the surgery (Fig. 1a). This CSF leakage, detected in the early postoperative period was resistant to conservative attempts for 2 months. Following a thorough debridement, duraplasty with tensor fascia lata graft was performed. A triangular flap, 12 × 13 cm in dimension, based on the dorsal perforator of the left 12th posterior intercostal artery, was designed. After identification of the neurovascular pedicle, an island flap including the lumbodorsal fascia was harvested (Fig. 1b). Inadequate flap advancement due to the dense scar tissue surrounding the pedicle was overcome by a counter clockwise flap rotation of 120°. Healing was uneventful and flap survived without complications. No neurological compromise due to primary disease was detected and an acceptable flap conformity into the recipient site was maintained throughout 3 years (Fig. 1c).

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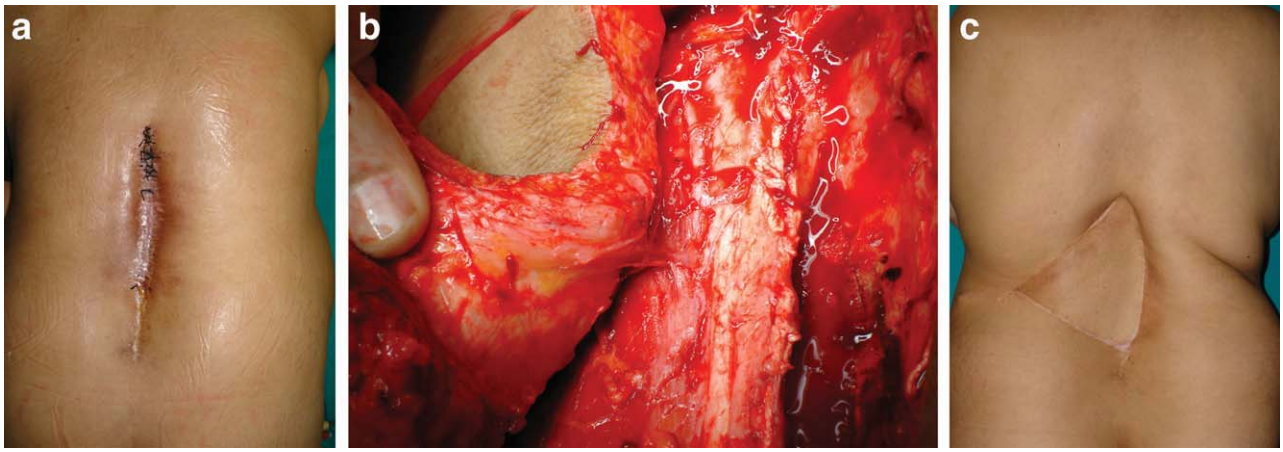

Figure 1. First case. (a) Unstable mid back scar with cerebrospinal fluid leak nonrespondent to conservative attempts. (b) Fasciocutaneous flap harvest, based on the dorsal perforator of the left 12th posterior intercostal artery. (c) Late result indicating a durable repair with an acceptable flap conformity into the recipient site at postoperatively third year. [Color figure can be viewed in the online issue, which is available at wileyonlinelibrary.com.]

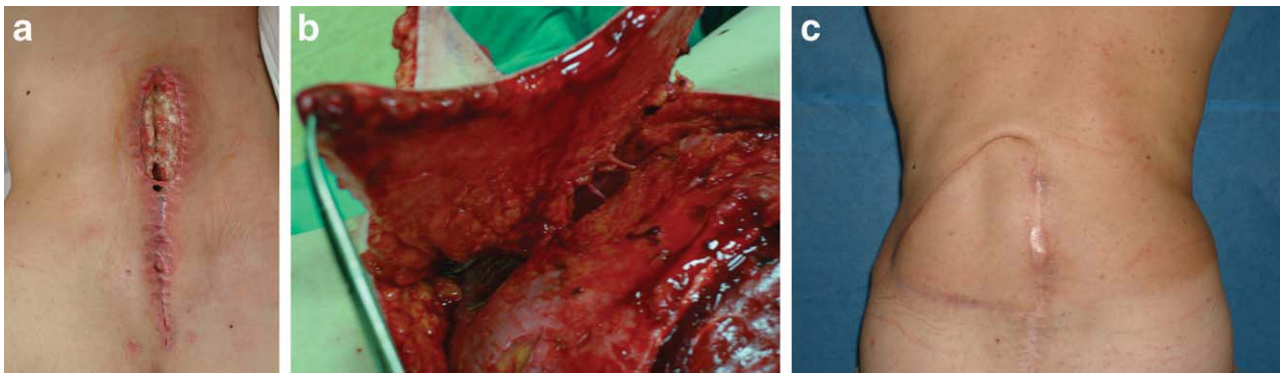

Figure 2. Second case. (a) Wound dehishence and infection with exposed instrumentation due to the burst fracture of L3 vertebra. (b) Adipocutaneous flap harvest, based on the left lumbar artery perforators. (c) Result at twentieth month revealed a durable coverage throughout one year. [Color figure can be viewed in the online issue, which is available at wileyonlinelibrary.com.]

Case 2

A 29-year-old male patient suffered from an unstable burst fracture of the third lumbar vertebra without any neurological deficit. Posterior stabilization of the lumbar vertebrae with transpedicular instrumentation resulted in an early wound dehiscence (Fig. 2a). He was managed by repeated minor debridements, saline irrigation, negative pressure wound therapy, and antimicrobial treatment. After 3 weeks, an adipocutaneous V-Y advancement flap (13 × 14 cm) based on the perforators of the left lumbar vessels was harvested while retaining the spinal instrumentation (Fig.2b). Flap survival was without complications. The signs of a persistent infection became evident during the second postoperative month and were suppressed by broad spectrum antibiotics until the removal of spinal instrumentation 6 months later. Recovery and radiographic evidence of fusion were maintained throughout 12 months (Fig. 2c).

Case 3

A 3-year-old boy suffered from myelomeningocele and associated anomalies (hydrocephalus, paraplegia, kyphosis, bowel, and bladder incontinence). He presented a widely indurated pressure sore on the left prominence of his lumbar gibbous with extensive regional scarring due to previous operations (Fig. 3a). After debridement, the dural sac was exposed and an adipocutaneous V-Y advancement flap (5 × 10 cm) based on the perforators of the ipsilateral lumbar vessels was harvested. Flap survived without complications and the pressure sore did not recur through a follow-up period of 2.5 years (Fig. 3b).

Case 4

A 3-year-old boy suffered from myelomeningocele and associated anomalies as the third case. He presented a widely indurated pressure sore on the left prominence of his lumbar gibbous adjacent to the vertical midline

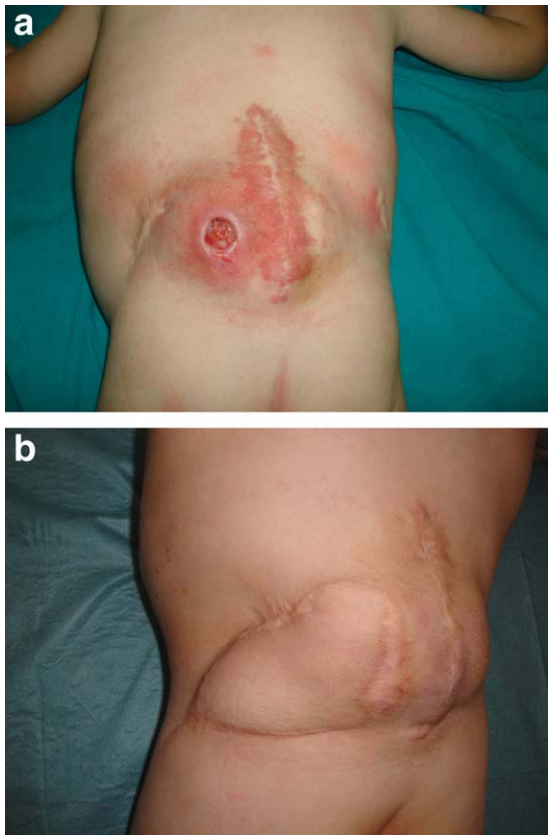

Figure 3. Third case. (a) A widely indurated pressure sore on the left prominence of lumbar gibbous with extensive regional scarring. (b) Late result at postoperatively third year without sore recurrence. [Color figure can be viewed in the online issue, which is available at wileyonlinelibrary.com.]

scar (Fig. 4a). After debridement, the dural sac was exposed and an adipocutaneous V-Y advancement flap (7 × 8 cm) based on the perforators of the ipsilateral lumbar vessels was harvested (Fig. 4b). Healing was uneventful and flap survived without complications. The pressure sore did not recur through a follow-up period of 9 months (Fig. 4c).

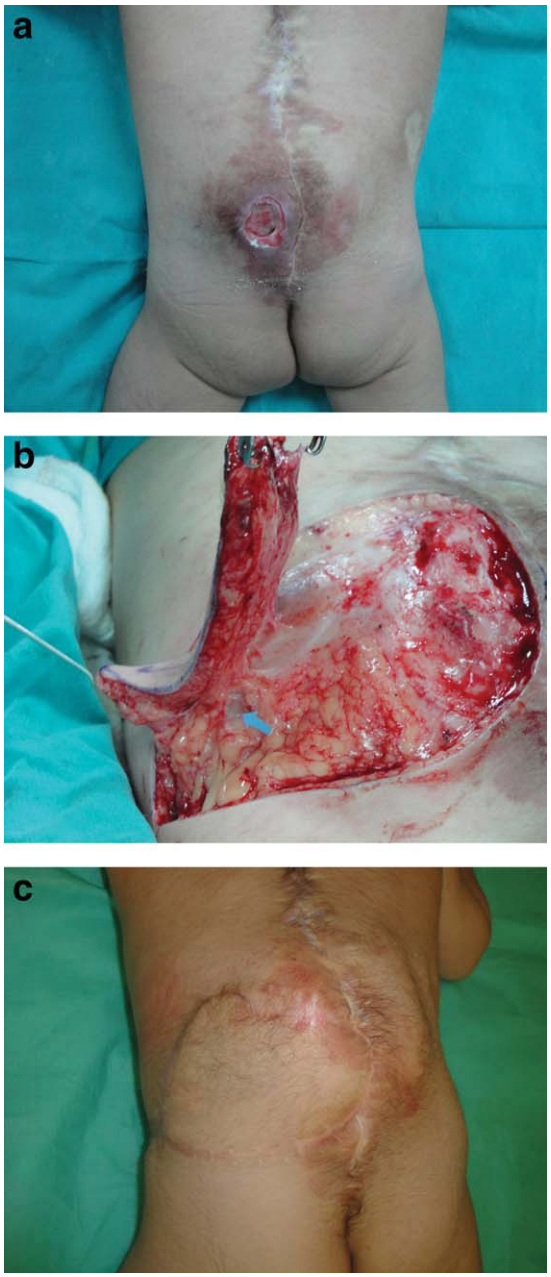

Figure 4. Fourth case. (a) Pressure sore on the left prominence of lumbar gibbous adjacent to the vertical midline scar. (b) Adipocutaneous flap harvest. The arrow indicates the lumbar artery perforators, immediately lateral to the erector spinae muscles. (c) Result at ninth month revealing an effective repair. [Color figure can be viewed in the online issue, which is available at wileyonlinelibrary.com.]

DISCUSSION

The management of complex wounds in the thoracolumbar trunk remains a challenge for reconstructive surgeons when compared to other sites of the back, due to a relative scarcity of reliable muscle flap alternatives. Following an effective wound care, preferably by the aid of negative pressure wound therapy in selected cases, coverage with the latissimus dorsi (LD) or paraspinal muscle flaps have been widely preferred.[1–8] The former, based on the distal circulation, has the advantage of obliterating dead space with an improved blood supply while permitting a two-layered closure when used with a skin component. Despite a negligible donor site morbidity in ambulatory patients, its sacrifice should be weighed in paraplegics in whom LD is an essential compensatory muscle in trunk elevation, walking, and sitting posture.[13] The latter can be used bilaterally in selected cases, if a spinal fusion is anticipated and if they are not involved with scar tissue due to previous operations and/or radio-

therapy. Partial use of both flaps was proposed to overcome the relevant drawbacks.[2,6]

Among other alternatives, bilateral bipedicled LD and gluteus maximus composite flap procedure has been proposed in myelomeningocele coverage, which includes two extensive flap procedures, disregarding the future flap options.[1,3,14] Free flap coverage of this region is rather challenging due to the scarcity of suitable recipient vessels. Free LD flap transfer on long vein grafts should be reserved for extreme cases, considering the probable functional loss and patient comorbidities through a time consuming procedure.[1,3,7–9] When local tissues are unavailable, transpelvic rectus abdominis musculocutaneous flap,[15] and omental flap[16] may also be used. The former is associated with high complication rates and avoided in patients who have undergone a laparotomy and in those with stomas.[7] The latter can also be harvested endoscopically, whereas both procedures necessitate a combined anterior and posterior approach which increases morbidity and creates problems in positioning. Potential complications secondary to the laparotomy include possible obstruction of the small bowel, hernia of the ventral wall, and fluid-electrolyte disturbances, which have limited the use of both flaps in the repair of complex spinal wounds.

Random skin flaps may have a limited value in back reconstruction due to mobility and donor site problems, rather they may restrict further repairs. In the last two decades, a remarkable evolution has been detected in reconstructive strategies of various body parts with the advance in perforator flap surgery. The efficacy of fascio/adipocutaneous flaps in osteomyelitis and chronic ulcers have been proved.[17–19] However their utility in complex thoracolumbar spine defects was reported sporadically, since the pioneering study of Kroll and Rosenfield,[20] including two relevant cases repaired with untitled perforator-based flaps. In their anatomical and clinical study of lumbar artery perforator flap, Kato et al[11] repaired a pressure sore on kyphotic lumbar spine with an island flap. Feinendegen and Klos[21] harvested a subcostal artery perforator flap for a large lumbar defect after tumor resection. Wong et al[22] presented long-term stable results in four relevant patients by using lateral intercostal perforator flap. Further anatomical refinements supported the use of lower thoracic/lumbar area for perforator flap harvest with its favorable tissue characteristics.[10,12,23–25] Despite the paucity of relevant studies, coverage with a perforator based fascio/adipocutaneous flap primarily seems optional rather than an extensive muscle/musculocutaneous flap procedure to reverse the overall systemic and local factors which often complicate the underlying pathologic process.

To the best of our knowledge, the dorsal perforator of the 12th posterior intercostal artery, which was used for flap design in our first case, was not previously reported for use for a flap harvest. In their anatomical study, Minabe and Harii found the dorsal perforators of 4th–12th posterior intercostals arteries constant in five fresh cadavers.[10] In another study, including eight formaldehyde-fixated and five saline-fixated cadavers and fifteen volunteers to investigate the anatomy of the subcostal (12th posterior intercostal) artery perforator flap, despite a constant perforator of the relevant artery was localized at the lateral border of the LD muscle, dorsal perforators were not encountered, possibly due to the technical prerequisites.[24] In children, despite lacking a muscle component, an adequate flap conformity into the wound cavity could also be achieved. Instead of their propeller counterparts, which may necessitate a tedious dissection with subcutaneous tunneling,[11] the V-Y design of those may further allow an easy repair with immediately adjacent tissues, while minimizing the donor site morbidity.[26] It is not recommended to skeletonize the pedicles for avoiding vascular spasm, nor an intramuscular dissection in ambulatory patients, whereas bilateral flap harvest should be considered if more advancement is needed.

The relentless infection encountered in the second case can be attributed to overlooked instrumentation failure, as it subsided immediately after instrument removal. These findings may be promising for further studies in prophylactic soft tissue coverage of spinal instrumentation, which has been proposed to avoid relevant complications.[3,8]

Our results, supporting the versatility and durability of perforator flaps in a selected group of patients, may help to refine the complex mid back wound repair algorhythm.

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